PATENT SPECIFICATION

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401,677

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COMPLETE SPECIFICATION.

Improvements in and relating to Surgical Filaments.

I, HANS ALBERT ROEDER, of Pariserstrasse 63, Berlin, W. 15, Germany, of German nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

In tying up arteries and tissues during operations or bringing together of the lips of a wound when stitching, the practice generally is to place a gut filament around the artery while the latter is clipped with a clamp forceps or around the tissue parts to be stitched so as to form a loop, which is then tightened by means of a surgical knot, and, when stitching wounds, to draw a gut filament or the like by means of a needle through the lips of the wound, to bring the lips together and then to knot the gut.

It has also been proposed to tie up blood vessels by means of surgical filaments formed into three loops, the first two loops being connected by slip knots which are drawn up tight, one after the other, after the first loop has been passed over the blood vessel to be tied up, appliances being provided having means for clamping the part to be tied up and means for drawing the loops tight. In one such proposal, prepared filaments are employed, the third loop of which is secured by a fixed knot. These proposals have the drawback that as the slip knots comprise only a single convolution of the filament, it is necessary to provide two slip knots which have to be tightened up separately in order to ensure the loop being maintained in the tightened condition on the part tied up, for which purpose tying appliances have to be employed which are of a somewhat complicated nature or else the second slip knot has to be tightened up by the fingers.

The present invention has for its object to avoid this drawback and with this object in view, the invention consists in a surgical filament, more particularly of gut, for tying up arteries and tissues during operations or for bringing together the lips of a wound, said filament having a preformed loop therein adapted to be slipped over the part or parts to be tied up or closed, said loop being provided with a running slip knot comprising a plurality of convolutions which allows the loop to be contracted by drawing it tight and maintains the loop in the contracted state without further knotting of the filament.

For manipulating the looped filament an instrument is provided for applying the looped filament to the desired place, said instrument receiving a filament having the preformed loop with the slip knot.

An instrument according to the invention comprises a bar-shaped member, one end of which is formed into a handle and the other end into a support for the prepared gut filament, the end of the support having a bore which, at the free end, opens into a ball-shaped part, and at the other end opens at the external surface of the end of the support.

The invention is illustrated by way of example in the accompanying drawing in which

Fig. 1 shows diagrammatically a surgical filament with a slip knot according to the invention.

Figs. 2 and 3 show a filament having a similar knot to that of Fig. 1, diagrammatically and in perspective,

Fig. 4 is a diagrammatic view of another way of forming the slip knot,

Fig. 5 shows a filament having a similar knot to that of Fig. 4,

Fig. 6 shows another way of forming the slip knot,

Fig. 7 is a filament having a slip knot similar to that of Fig. 2 shown diagrammatically, formed by twisting one end of the filament around the middle part thereof and a separate surgical filament,

Fig. 8 shows a filament having a slip knot according to Fig. 7 in perspective,

Fig. 9 shows a modification of the filament shown in Fig. 1,

Fig. 10 shows in elevation a constructional form of an instrument for applying the filaments,

Fig. 11 is a modified constructional form of instrument,

Fig. 12 is a section on line XII—XII of Fig. 11,

Fig. 13 a further modified form of instrument partly broken away,

Fig. 14 a side view of the upper part of Fig. 10 and

Fig. 15 another form of the instrument to an enlarged scale.

Referring to the drawings, Figs. 1 to 3 show filaments having preformed loops with running slip knots, for forming which one end of the filament is twisted by winding it helically about itself and about the other free end of the filament. The end of the helically wound portion of the filament is inserted into the lower part of the loop and slipped under one of the helical convolutions. One end of the surgical filaments bears the reference numeral 1 and the other end the numeral 2. 3 is the loop itself. It is made smaller by pulling the end 1 in the direction of the arrow A when the slip knot 4 is held fast

Fig. 2 shows another way of forming the slip knot, in which the end 2 of the filament is given a half turn around the middle part of the filament before it is twisted. The loop 3 is in this case also contracted by pulling the end 1. 5 is the part of the filament wrapped around the middle part thereof.

Fig. 3 shows on a larger scale the knot illustrated diagrammatically in Fig. 2 drawn together. Owing to the slip knot comprising a plurality of convolutions, it is not possible to enlarge the loop in the surgical filament after it has been contracted on the part to be tied up and the knot tightened, by pulling in the direction of the arrows B.

In the case of the filament shown in Fig. 4 the filament end is twisted around the middle part of the filament in the form of a figure 8 and is slipped through the lower bend of the figure 8. The knot is drawn tight and secured by pulling the end 1 of the filament.

In Fig. 5 the knot is similar to that of Fig. 4 but before being formed into a figure 8 the end of the filament is given a half turn around the middle part of the filament.

In Fig. 6 the slip knot is formed by coiling the filament end around the middle part of the filament to form a number of half hitches.

According to Fig. 6 on the loop being pulled, the individual parts of the knot are laid tightly one on the other and the outer filament end is nipped.

The forms of knot illustrated are only given by way of example. It is not essential that the knot shall be formed as described above and other forms of running slip knot may be used, as the gut swells owing to the moisture of the body, causing the knot to tighten up on the middle part of the filament, thus tying off the artery, as experiments have proved.

According to Fig. 7 a gut filament 6 is provided with a loop 7 and a running slip knot, which corresponds substantially to the slip knot shown in Fig. 2, the end of the filament in this case, however, being twisted about the middle part of the filament and about a second surgical filament 8, so that the slip knot formed by the filament 6 is slidable on the filament 8. For bringing together the lips of a wound the upper end of the filament 8 is threaded in a needle and after the two lips of a wound which are to be drawn together have been pierced by the needle and after the needle has been removed, the loose end of the filament 8 is coiled round one side of the loop 7. By pulling at the filament 8 and the free end of the filament 6 in the direction C, the loop 7 and the loop formed by the loop 7 and the part of the filament 8 coiled around it are contracted and the lips of the wound are brought together, the loop formed by the filaments 6 and 8 remaining contracted without any danger of expanding again.

From Fig. 8 it will be clearly seen how the filament 6 can be slid freely in both directions on the filament 8.

According to Fig. 9 one end of the filament is wrapped around the middle part of the filament and around a tubular pin 9 the filament being twisted in a similar manner to that shown in Fig. 1. The end 10 of the filament is threaded into a surgical needle 11. After the tissues have been pierced, this end can be passed through the pin 9 in the direction of the arrow D. After the pin has been withdrawn from the slip knot the parts of the tissue are tied off in the manner above described.

As shown in Fig. 10 the appliance for bringing the filament into position consists of a bar-shaped part 11^1 which is provided at one end with a somewhat thicker handle part and at the other end with a slightly tapered carrier part. The handle, as shown in the drawing, is provided with rings 12, 13, 14 which are arranged in a known manner so that they can be grasped with the thumb and the first and second finger of the hand. The carrier part is tubular, has a channel 15 and is preferably bent over at an angle of 45° to the part 11^1 as will be seen from Fig. 14. The free end 16 of the carrier part is ball-shaped, so as to avoid injury when the instrument is in use.

When the instrument is to be used, a gut filament 17, which is provided with a loop as described above, but which is

not shown in Fig. 10, is introduced by its free end at 16 into the channel 15, the filament being threaded through the channel until the slip knot lies against the ball-shaped part 16. The free end of the gut filament which projects from the channel 15 is seized with the fingers of one hand and the instrument with the fingers of the other hand. With the instrument the loop of the gut filament is brought over the place to be tied off, and passed over the clamp forceps which have been applied and drawn completely tight, the fingers of one hand gripping the rings 12, 13 and 14 and the other hand drawing the loop of the gut filament tight.

As shown in Fig. 11 the rings for the middle and first finger may also be slidable on a non-circular, for instance a four-cornered, part 18 of the handle up to the point where they strike against the stop 19. In this extreme position they are held by a leaf spring 20. As shown in Fig. 11 the left-hand ring 12 may be pivoted on a pin 21 which is screwed into a guide part 22 which is slidable on the part 18. The inner end of the ring part 12 is eccentric, as will be seen from the Figure, so that the gut filament 17 can be gripped between the right-hand ring 13 and the left-hand ring 12. The ring 12 is held in this position by a spring 23.

When a gut filament is introduced into the tubular part and is clamped between the rings 12 and 13, the loop of the filament is first reduced in size by moving the rings 12 and 13 in the direction of the arrow A, and on the pull continuing is drawn completely tight. After the artery has been tied off the gut filament 17 is freed from the clamped position by swinging over the ring 12 in the direction of the arrow E.

The constructional form shown in Fig. 13 differs from that of Fig. 11 only in this, that the two rings 12 and 13 are rigidly connected to the slidable part 22. The gut filament can in this case be twined round the rings. By moving the rings downwards the loop is contracted or drawn tight.

In the constructional form shown in Fig. 15 the ball-shaped part 16 is arranged to be slipped on to the free end of the part 11^1. The bent over end 24 is not bored but has a groove 25. The gut filament 17 can therefore be threaded into the ball-shaped part 16 and the connection between the instrument and the gut filament is effected by slipping the ball-shaped part 16 on to the part 24. The bore 26 of the ball-shaped part is for this purpose made slightly conical, widening towards the part 24, and the part 24 is made with a corresponding taper.

The end of the carrier part may lie in any plane with respect to the plane of the rings, according to the purpose for which the instrument is to be used.

In place of the leaf spring shown in the drawing, a leaf spring which is not shown may be used, which extends over the entire length of the part 18 or is disposed in the slidable part 22, so that the latter can be held in any position by friction.

It is to be understood that so far as my invention is concerned with the looped filaments per se, as distinct from the instrument for applying them, I do not claim to cover by my invention the formation of such looped filaments by those concerned in performing the operation in which such filaments are employed but I only claim as my monopoly such preformed filaments as articles of trade or commerce.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A surgical filament, more particularly of gut, for tying up arteries and tissues during operations or for bringing together the lips of a wound, said filament having a preformed loop therein adapted to be slipped over the part or parts to be tied up or closed, said loop being provided with a running slip knot comprising a plurality of convolutions which allows the loop to be contracted by drawing it tight and maintains the loop in the contracted state without further knotting of the filament.

2. A surgical filament as claimed in claim 1, characterised by the feature that the slip knot is formed by one end of the filament being wound helically about itself and about the other free end of the filament, the end of the helically wound portion of the filament being inserted into the lower part of the loop and slipped under one of the helical convolutions (Fig. 1).

3. A surgical filament as claimed in claim 2, characterised by the feature that the end of the filament is given a half turn around the middle part of the filament before it is twisted (Figs. 2 and 3).

4. A surgical filament as claimed in claim 1, characterised by the feature that the filament end is twisted around the middle part of the filament in the form of a figure 8 and the filament end is slipped through the lower bend of the figure 8 (Fig. 4).

5. A surgical filament as claimed in claim 4, characterised by the feature

that before the filament end is twisted in the form of a figure 8 it is given a half turn around the middle part of the filament (Fig. 5).

6. A surgical filament as claimed in claim 1, characterised by the feature that the slip knot is formed by coiling the filament end around the middle part of the filament to form a number of half hitches.

7. A modification of the surgical filament as claimed in claim 2, characterised by the feature that the helically twisted end of the filament is also twisted about a separate filament (Figs. 7 and 8).

8. A surgical filament, more particularly of gut for tying up tissues and bringing together the lips of a wound, in combination with a tubular pin, one end of the filament being twisted about the middle part of the same and around the said pin, through which the untwisted portion of the filament is adapted to be passed to form a loop provided with a running slip knot comprising a plurality of convolutions which, after removal of the tubular pin, allows the loop to be contracted by drawing it tight and maintains the loop in the contracted state without further knotting of the filament.

9. An instrument for applying a surgical filament as claimed in claim 1, characterised by a bar-shaped member, one end of which is formed into a handle and the other end into a support for the prepared gut filament, the end of the support having a bore which, at the free end, opens into a ball-shaped part, and at the other end opens at the external surface of the end of the support.

10. An instrument as claimed in claim 9, characterised by the feature that the end of the support remote from the handle is bent over so as to form an angle preferably of about 45° to the handle part.

11. An instrument as claimed in claim 9 or 10, characterised by the feature that the handle is provided with rings for holding the instrument by means of two fingers and a thumb, namely one ring at the extreme end of the handle and two opposed rings, one on each side of the handle and spaced from the ring at the end of the handle.

12. An instrument as claimed in claim 11, characterised by the feature that the two opposed rings are mounted on a guide member which is slidable on a non-circular, for instance four-cornered part of the handle end said guide member being held in position by a retaining spring.

13. An instrument as claimed in claim 12, characterised by the feature that one ring is movable, for instance pivoted, and is provided with an eccentric part which bears preferably under spring pressure against the other ring for clamping the gut end on the guide member.

14. A modification of the instrument as claimed in claim 9, characterised by the feature that the ball-shaped part is removable and has a conical bore with which it can be slipped on to the end of the support which has a groove for receiving the gut filament.

15. The improved surgical filaments, substantially as hereinbefore described with reference to the accompanying drawings.

16. The improved instruments for applying the surgical filament substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 10th day of May, 1932

MARKS & CLERK.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1933.

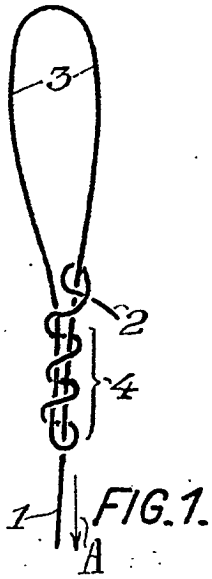

FIG. 1.

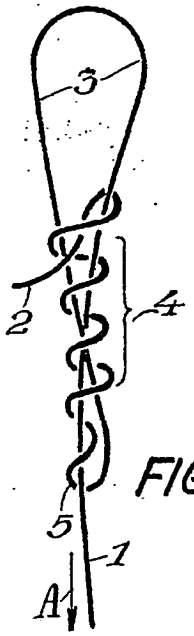

FIG. 2.

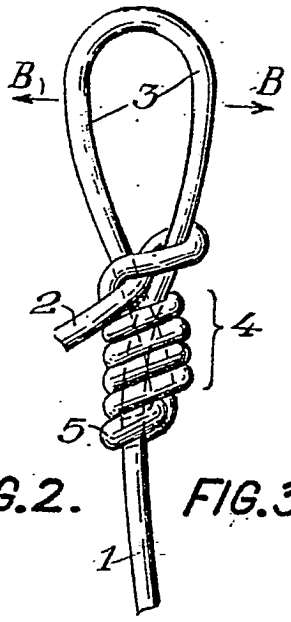

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

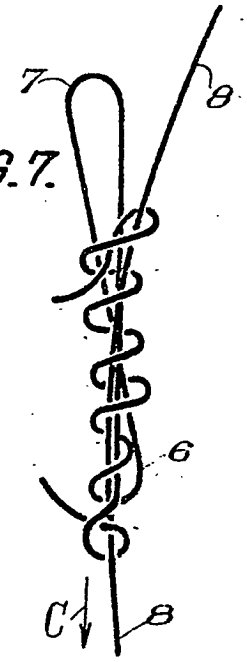

FIG. 7.

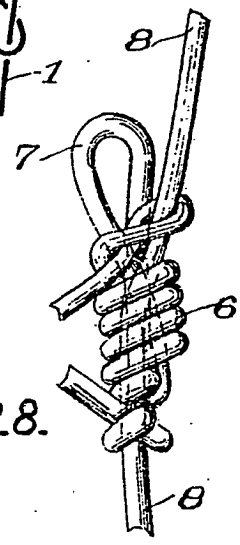

FIG. 8.

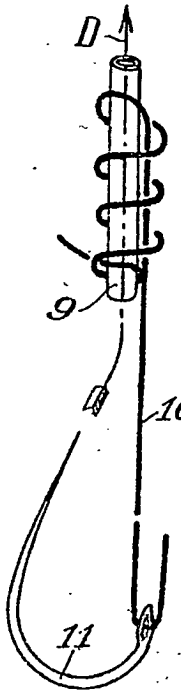

FIG. 9.

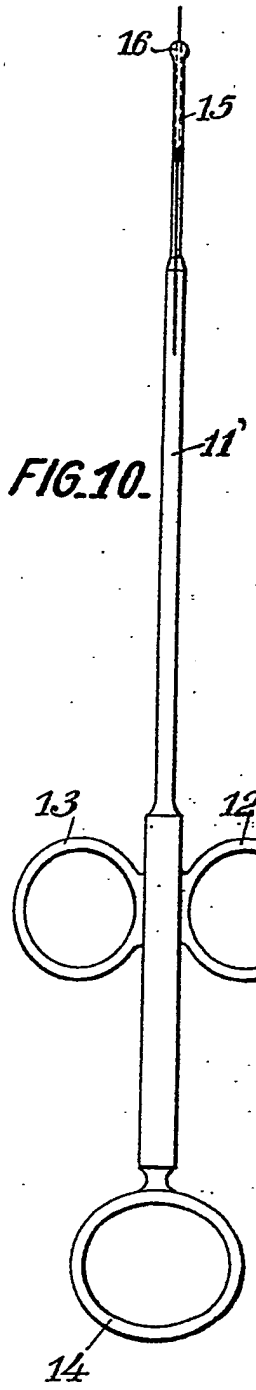

FIG.10.

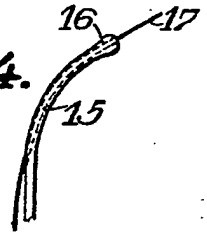

FIG.14.

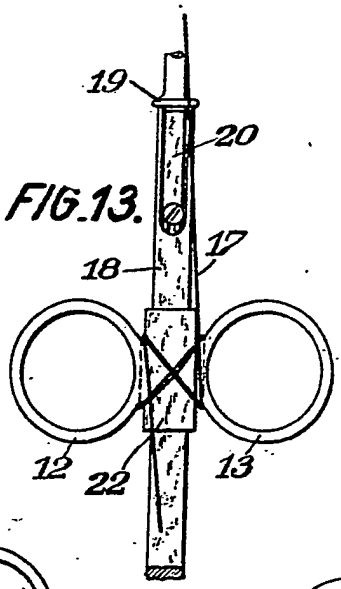

FIG.13.

FIG.11.

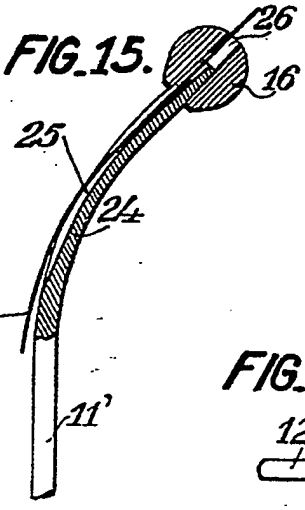

FIG.15.

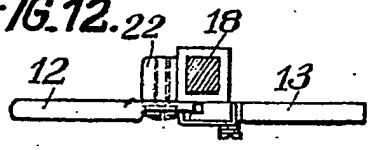

FIG.12.

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SHEET 1

[This Drawing is a reproduction of the Original on a reduced scale.]

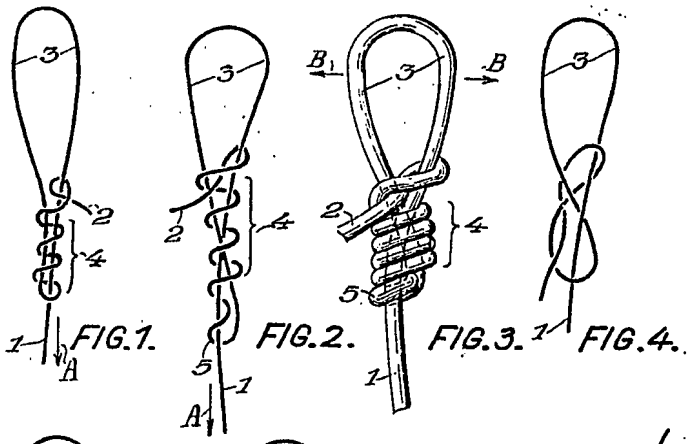

FIG.1. FIG.2. FIG.3. FIG.4.

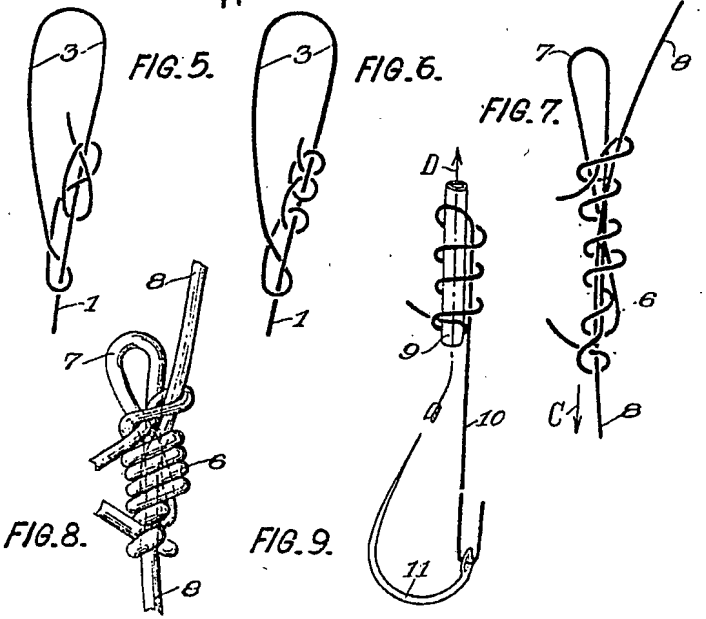

FIG.5. FIG.6. FIG.7. FIG.8. FIG.9.

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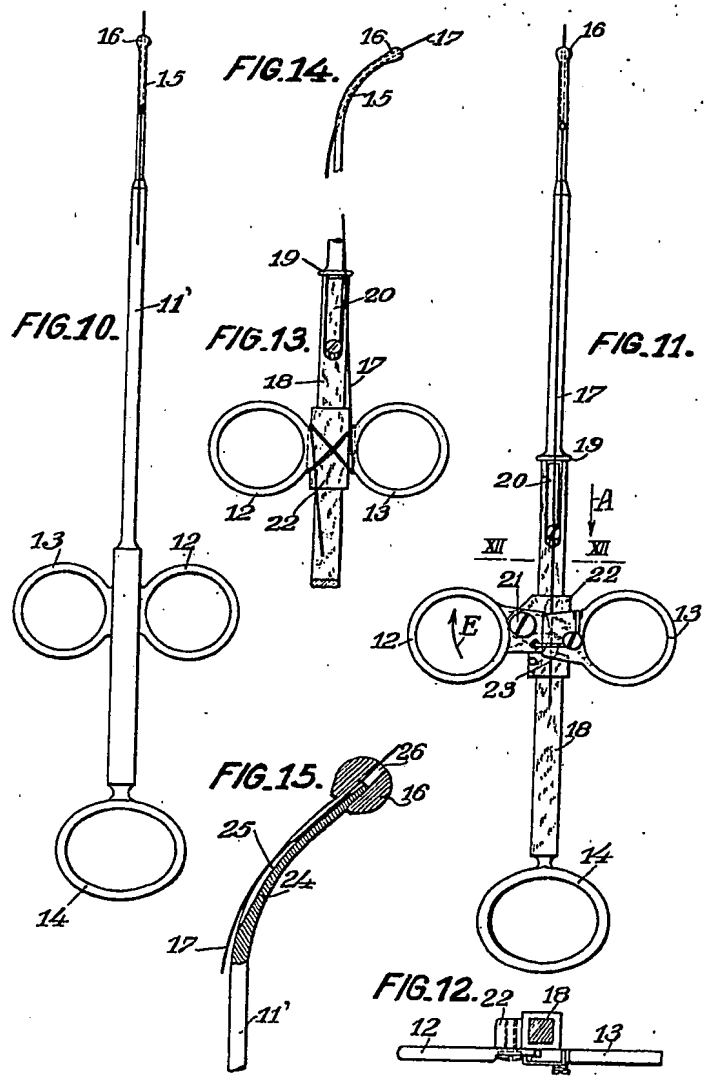

FIG.10. FIG.14. FIG.13. FIG.11. FIG.15. FIG.12.